

Medical Science

25(118), December, 2021

To Cite:

Al-Ghadeer HA, Al-Taisan AA, Almajed FA, Alaithan ZA, Alethan HM, Alabdrabulrida SA, Al-Muaibid AF, Al-Shaban HR, Alhamaid YA, Alkuwayti MA. A descriptive survey investigating awareness of computer vision syndrome among general population in eastern region, Saudi Arabia. Medical Science, 2021, 25(118), 3400-3408

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Peer-Review History

Received: 12 November 2021

Reviewed & Revised: 14/November/2021 to 11/December/2021

Accepted: 13 December 2021

Published: December 2021

Peer-review Method

External peer-review was done through double-blind method.

A descriptive survey investigating awareness of computer vision syndrome among general population in eastern region, Saudi Arabia

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ABSTRACT

Background: Computer vision syndrome (CVS) is a group of vision-related manifestation as result of spending contentious hours on screen. The digitalization is becoming an integral part of our life in which making the eyes, musculoskeletal health related problems increased many folds. This study aims in determining the prevalence of CVS, the contributing risk factors of the syndrome and commonly presenting symptoms as well as assessing the awareness and proper practice of computer use. **Methodology:** A descriptive cross-sectional based study conducted among 1345 participants from eastern region, Saudi Arabia during the period of August to October 2021. The questionnaire collected data is socio-demographic data with CVS symptoms and associated risk factors. Knowledge, attitude and practices toward CVS in participants are also collected. Considering chi-square significant if $P < 0.05$. **Results:** A total of 1345 included in the study with a mean age of 27.3 ± 14.9 years old, 66.2% of whom were female and 53.9% were male. The average usages of electronic devices were 1-5 hours reported by 41.9% and 6-10 hours among 39.1%. Exact of 460 (34.2%) participants know about CVS and 52.8% of them applying the 20 / 20 / 20 rule. The frequent complained experience was eye strain followed by headache. **Conclusion:** CVS is common among Eastern province of Saudi Arabia; significant risk factors need to be addressed to reduce the symptom as well as more awareness about CVS is needed. So, it is essential to establish the preventive measures to reduce this syndrome.

Keywords: Computer vision syndrome, dry eye, risk factors, Saudi Arabia.



DISCOVERY
SCIENTIFIC SOCIETY

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1. INTRODUCTION

Recent technology and the outbreak of electronic devices has become a worldwide issue due to its consequences on health and eye (Scalet, 1987; Wallin et al., 1994). Many computer and devices users experience eye related issues which includes, red and tired eye, eyestrain, blurred and double vision, eye itching. All these eyes related complains collectively referred to as computer vision syndrome (Trusiewicz et al., 1995). Computer vision syndrome defined by American Optometric Association, as a group of eye-and vision related symptoms result from long period of electronic devices usage (American Optometric Association, 2020). Using digital devices for a long period time also lead to other non-ocular symptoms including neck and shoulder pain, which considered by some healthcare providers as part of digital eye strain (Malni & Bhatnagar, 1991).

Usage of electronic devices not only restricted to non-useful aims but also as part of careers. Many careers are depended on the usage for at least 8-10 hours daily of screens. Usage of technology like computers is increasing in medical profession and having a role in functioning of big hospitals (Malni & Bhatnagar, 1991). Various medical fields are applying computer techniques which includes hospital information system, data analysis in medicine, laboratory computing, computer assisted decision making (CMD), care of critical ill patients, computer assisted therapy, and medical imaging by radiologist (Mehta, 1194). Other non-medical field jobs are as well computer and electronic devices depended. A study conducted in Saudi Arabia among health science students to evaluate the commonness and contributing danger elements of Computer vision syndrome, 334 understudies were taken an interest in this review which infer that vision symptom manifestations are seen more among health sciences students because of their incessant utilization of various electronic devices (Altalhi et al., 2020; Ranasinghe et al., 2016).

Similar study was done in Sri Lanka to evaluate the predominance and contributing danger elements of computer vision syndrome, 2500 of computer office workers were invited to participate in the study from every one of the nine provinces of Sri Lanka in 2009. The result of this study showed that Sri Lankan computer workers had a high pervasiveness of computer vision syndrome and the factors related with how sever the disorder were identified with the length of occupation and presence of prior eye sickness (Ranasinghe et al., 2016).

Computer vision syndrome is considered as a widespread disease among electronic device workers and the severity of the presentation correlated to the time spent at work (Kowalska et al., 2011). Furthermore, as the working hour on electronic devices is high with the new technologies, the effect on population is increased. A detailed review of literature concludes a research gap on the treatment and management part in previous research (Bali et al., 2007). One study was done in India in 2007 to assess the knowledge, attitudes, and practices in Indian Ophthalmologists regarding computer vision syndrome which conclude that all respondent's Indian ophthalmologist were aware of Computer vision syndrome however confusion regarding treatment guidelines and modalities was observed (Bali et al., 2007).

The aim of current study is directed toward checking the awareness of eastern population in Saudi Arabia about computer vision syndrome, wither they were diagnosed with computer vision syndrome and what is the line of management they are taking to treat.

2. MATERIAL AND METHODOLOGY

An observational cross-sectional study was conducted during the period of August to October 2021 among 1345 citizen of Eastern province, Saudi Arabia. The data were collected through a structure self-administrated questionnaire distributed online. Data were collected from participants via validated self-administrated. The questionnaire will be generated using Google survey and it will be distributed on different social media platforms on the period between May and September 2021. The questionnaire will have two parts:

The first part will be about the participants' demographical data. It includes age, gender, place of residency, educational level, occupation, if the participant has refractive error, if they have optical correction (glasses or contact lenses) and if they have history of eye diseases or surgery. There will be questions about the participants' digital devices using habits. Participants will be asked about the type of device used, and the total number of hours of screen time per day.

The second part will be about CVS in which participants will be asked about the frequency of CVS-symptoms experienced. These symptoms include headache, dryness, difficulty focusing, itchiness, excessive blinking, burning sensation, blurred vision, heavy eyelids, sensitivity to bright light, eye pain, eye redness, tearing, foreign body sensation or double vision. Participants will also be asked about their attitude toward preventive measures of CVS which includes; 20-20-20 rule Periodic blinking, frequent use of lubricants, keeping the electronic device more than 40 cm away from the eyes and below the level of the eyes, using ceiling lighting instead of a desk lamp or light hitting directly on the eyes, avoiding sitting in front of direct blow of air to the eyes or where there is light reflected on the screen, using antiglare screen, or use of eyedrops lubricants.

Data analysis

After data were extracted, it was revised, coded, and fed to statistical software IBM SPSS version 22(SPSS, Inc. Chicago, IL). All statistical analysis was done using two tailed tests. P value less than 0.05 was statistically significant. Descriptive analysis preformed for all variables. Also, participants' utilization habits of the different electronic devices and their practice was displayed in frequency tables besides the most experienced symptoms of computer vision syndrome. Also, patients' awareness regarding computer vision syndrome and its related 20/20/20 rule application was assessed. Cross tabulation was used to show the distribution of public awareness regarding CVS by their bio-demographic data and electronic devices utilization habits. Significance of relation was assessed using Pearson chi-square test.

3. RESULTS

A total of 1345 participants fulfilling the inclusion criteria completed the study questionnaire. Participant's ages ranged from 18 to 55 years with mean age of 27.3 ± 14.9 years old. Exact of 66.2% of the study respondents were females and 53.9% were married and 41.3% were single. As for education, 73.4% were university graduated and 21.9% had below university level of education. Regarding job, 33.1% were not employed while 31.7% were non-health care workers and 35.2% were health care workers. Exact of 12.7% had chronic health problems. Also, 42.9% had refractive errors among which, 82.8% wear eye glasses and 21.7% wear contact lenses. Only 5.2% had history of eye diseases and 13.3% undergone eye surgery (Table 1).

| Table 1 Bio-demographic data of study participants in Eastern region, Saudi Arabia | | | |
|---|----------------------------------|------|-------|
| Bio-demographic data | | No | % |
| Age in years | 18-25 | 592 | 44.0% |
| | 26-35 | 272 | 20.2% |
| | 36-45 | 273 | 20.3% |
| | > 45 | 208 | 15.5% |
| Gender | Male | 455 | 33.8% |
| | Female | 890 | 66.2% |
| Marital status | Single | 556 | 41.3% |
| | Married | 725 | 53.9% |
| | Divorced/ widow | 64 | 4.8% |
| Education | Below university | 295 | 21.9% |
| | University | 987 | 73.4% |
| | Post graduate | 63 | 4.7% |
| Job title | Not employed | 445 | 33.1% |
| | Non-health care worker / student | 426 | 31.7% |
| | Health care worker / student | 474 | 35.2% |
| Have chronic disease | Yes | 171 | 12.7% |
| | No | 1174 | 87.3% |
| Do you have refractive error? | Yes | 577 | 42.9% |
| | No | 768 | 57.1% |
| Do you wear optical correction (glasses)? | Yes | 478 | 82.8% |
| | No | 99 | 17.2% |
| Do you wear optical correction (contact lenses)? | Yes | 125 | 21.7% |
| | No | 452 | 78.3% |
| Do you have history of eye disease? | Yes | 70 | 5.2% |
| | No | 1275 | 94.8% |
| Do you have history of eye surgeries? | Yes | 179 | 13.3% |
| | No | 1166 | 86.7% |

Electronic devices usage habits among study participants in Eastern region, Saudi Arabia. The most reported used electronic devices were smartphones (80.4%), followed by computers (10.3%), and tablets (6.9%). As for average usage time per day, 41.9% reported for 1-5 hours, 39.1% reported for 6-10 hours, while only 3.6% used devices for less than 1 hour. Exact of 43.9% of the participants reported that the average viewing distance from the eye to the computer is 40-75 cm and 77.8% use the level of computer screen as same level to eye. Keeping constant blinking was reported among 69.9% of the participants, 78.8% use ceiling lighting while using electronic devices, 73.4% avoid sitting in a place where the air hits directly in the eyes, and 76.6% avoiding sitting at a location where there is light reflected on the screen. Only 29.5% use antiglare screen while the computer and 49.6% you use rewetting drops (table 2). Public awareness regarding computer vision syndrome and its role in Eastern region, Saudi Arabia, Exact of 460 (34.2%) participants know about CVS and 52.8% of them applying the 20 / 20 / 20 rule (Figure 1).

Table 2 Electronic devices usage habits among study participants in Eastern region, Saudi Arabia

| Electronic devices usage habits | | No | % |
|--|--------------------|------|-------|
| Which of the following devices do you use on a daily basis | Smartphone | 1082 | 80.4% |
| | Tablet | 93 | 6.9% |
| | Computer | 138 | 10.3% |
| | TV | 32 | 2.4% |
| What is the total number of hours of usage of all digital devices you use on a daily basis | < 1 hour | 49 | 3.6% |
| | 1-5 hours | 563 | 41.9% |
| | 6-10 hours | 526 | 39.1% |
| | > 10 hours | 207 | 15.4% |
| What is the average viewing distance from the eye to the computer? | < 40 cm | 698 | 51.9% |
| | 40-75 cm | 590 | 43.9% |
| | > 75 cm | 57 | 4.2% |
| What is the Level of computer screen as compare to eye? | Equal to eye level | 1047 | 77.8% |
| | Above eye level | 223 | 16.6% |
| | Below eye level | 75 | 5.6% |
| When using electronic devices, do you keep blinking constantly? | Yes | 507 | 37.7% |
| | Sometimes | 433 | 32.2% |
| | No | 405 | 30.1% |
| Do you use ceiling lighting while using electronic devices? | Yes | 774 | 57.5% |
| | Sometimes | 287 | 21.3% |
| | No | 284 | 21.1% |
| Do you avoid sitting in a place where the air hits directly in the eyes? | Yes | 757 | 56.3% |
| | Sometimes | 230 | 17.1% |
| | No | 358 | 26.6% |
| Do you avoiding sitting at a location where there is light reflected on the screen? | Yes | 847 | 63.0% |
| | Sometimes | 183 | 13.6% |
| | No | 315 | 23.4% |
| Do you use antiglare screen while the computer? | Yes | 283 | 21.0% |
| | Sometimes | 114 | 8.5% |
| | No | 948 | 70.5% |
| Do you use rewetting drops? | Yes | 319 | 23.7% |
| | Sometimes | 349 | 25.9% |
| | No | 677 | 50.3% |

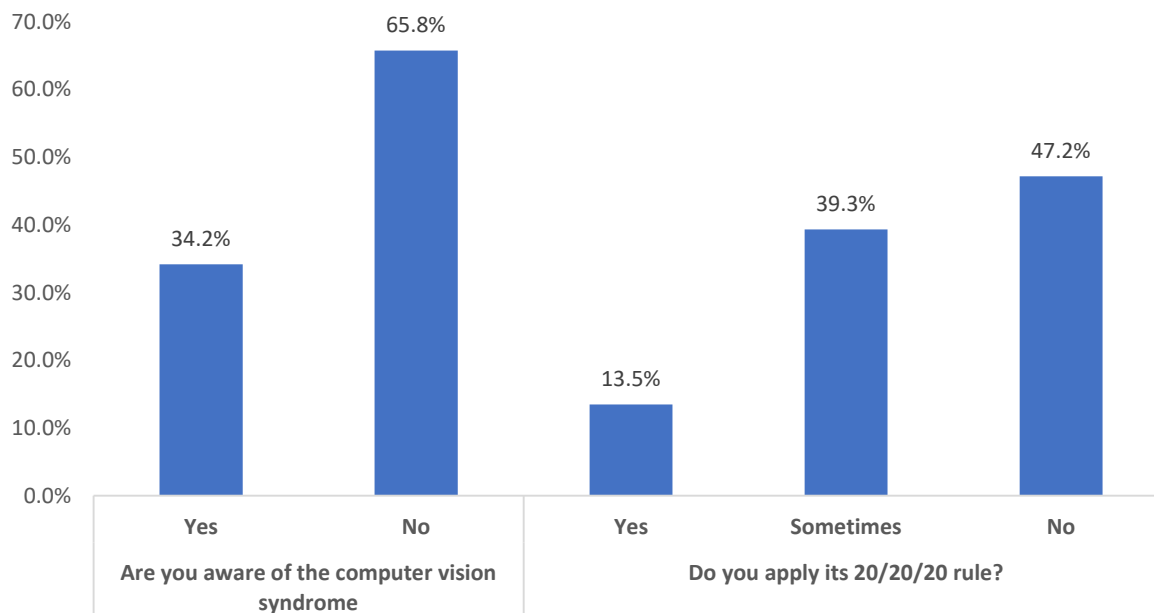


Figure 1 Public awareness regarding computer vision syndrome and its role in Eastern region, Saudi Arabia

Computer vision syndrome experienced symptoms by study participants in Eastern region, Saudi Arabia. Exact of 92.3% of the participants' complained of eye strain, 90.9% complained for headache, 89.3% complained of difficulty focusing, 87.4% complained of Sensitivity to bright light, 87% complained of eye dryness, 84.1% complained of itching sensation, and 81.6% complained of tearing (Table 3). The least reported symptoms were double vision (67.1%), and heavy eye lids (67.6%).

Table 3 Computer vision syndrome experienced symptoms by study participants in Eastern region, Saudi Arabia

| Symptoms | Never | | Rarely | | Sometimes | | Often | | Usually | | Always | |
|-----------------------------|-------|-------|--------|-------|-----------|-------|-------|-------|---------|-------|--------|-------|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Eye strain | 104 | 7.7% | 186 | 13.8% | 615 | 45.7% | 65 | 4.8% | 235 | 17.5% | 140 | 10.4% |
| Headache | 123 | 9.1% | 293 | 21.8% | 545 | 40.5% | 108 | 8.0% | 168 | 12.5% | 108 | 8.0% |
| Dryness | 175 | 13.0% | 262 | 19.5% | 428 | 31.8% | 132 | 9.8% | 190 | 14.1% | 158 | 11.7% |
| Difficulty focusing | 144 | 10.7% | 287 | 21.3% | 500 | 37.2% | 141 | 10.5% | 167 | 12.4% | 106 | 7.9% |
| Itchiness | 214 | 15.9% | 285 | 21.2% | 440 | 32.7% | 147 | 10.9% | 172 | 12.8% | 87 | 6.5% |
| Excessive blinking | 252 | 18.7% | 319 | 23.7% | 404 | 30.0% | 203 | 15.1% | 108 | 8.0% | 59 | 4.4% |
| Burning sensation | 255 | 19.0% | 303 | 22.5% | 409 | 30.4% | 161 | 12.0% | 134 | 10.0% | 83 | 6.2% |
| Blurred vision | 262 | 19.5% | 334 | 24.8% | 391 | 29.1% | 157 | 11.7% | 145 | 10.8% | 56 | 4.2% |
| Heavy eyelids | 436 | 32.4% | 286 | 21.3% | 325 | 24.2% | 161 | 12.0% | 90 | 6.7% | 47 | 3.5% |
| Sensitivity to bright light | 170 | 12.6% | 203 | 15.1% | 385 | 28.6% | 144 | 10.7% | 235 | 17.5% | 208 | 15.5% |
| Eye pain | 287 | 21.3% | 310 | 23.0% | 380 | 28.3% | 168 | 12.5% | 118 | 8.8% | 82 | 6.1% |
| Eye redness | 301 | 22.4% | 338 | 25.1% | 342 | 25.4% | 181 | 13.5% | 118 | 8.8% | 65 | 4.8% |

| | | | | | | | | | | | | |
|------------------------|-----|-------|-----|-------|-----|-------|-----|-------|-----|------|-----|------|
| Tearing | 247 | 18.4% | 307 | 22.8% | 380 | 28.3% | 187 | 13.9% | 123 | 9.1% | 101 | 7.5% |
| Foreign body sensation | 324 | 24.1% | 293 | 21.8% | 357 | 26.5% | 195 | 14.5% | 114 | 8.5% | 62 | 4.6% |
| Double vision | 442 | 32.9% | 281 | 20.9% | 308 | 22.9% | 203 | 15.1% | 81 | 6.0% | 30 | 2.2% |

Factors associated with public awareness of computer vision syndrome in Eastern region. Exact of 61.2% of participants who use electronic devices less than 1 hour were aware of CVS compared to 31.4% of those who use for more than 10 hours with recorded statistical significance ($P=.001$). Also, 37.6% of the participants who use average viewing distance from the eye to the computer of 40-75 cm were aware of the syndrome versus 28.1% of those who use distance of more than 75 cm (Table 4). All other factors were insignificantly associated with the public awareness regarding the syndrome.

Table 4 Factors associated with public awareness of computer vision syndrome in Eastern region

| Factors | | Are you aware of the CVS | | | | p-value |
|--|----------------------------------|--------------------------|-------|-----|-------|---------|
| | | Yes | | No | | |
| | | No | % | No | % | |
| Age in years | 18-25 | 212 | 35.8% | 380 | 64.2% | .383 |
| | 26-35 | 91 | 33.5% | 181 | 66.5% | |
| | 36-45 | 96 | 35.2% | 177 | 64.8% | |
| | > 45 | 61 | 29.3% | 147 | 70.7% | |
| Gender | Male | 169 | 37.1% | 286 | 62.9% | .104 |
| | Female | 291 | 32.7% | 599 | 67.3% | |
| Education | Below university | 109 | 36.9% | 186 | 63.1% | .452 |
| | University | 332 | 33.6% | 655 | 66.4% | |
| | Post graduate | 19 | 30.2% | 44 | 69.8% | |
| Job tittle | Not employed | 152 | 34.2% | 293 | 65.8% | .969 |
| | Non-health care worker / student | 144 | 33.8% | 282 | 66.2% | |
| | Health care worker / student | 164 | 34.6% | 310 | 65.4% | |
| Have chronic disease | Yes | 59 | 34.5% | 112 | 65.5% | .929 |
| | No | 401 | 34.2% | 773 | 65.8% | |
| Do you have refractive error? | Yes | 206 | 35.7% | 371 | 64.3% | .314 |
| | No | 254 | 33.1% | 514 | 66.9% | |
| Do you have history of eye disease? | Yes | 20 | 28.6% | 50 | 71.4% | .308 |
| | No | 440 | 34.5% | 835 | 65.5% | |
| Do you have history of eye surgeries? | Yes | 67 | 37.4% | 112 | 62.6% | .328 |
| | No | 393 | 33.7% | 773 | 66.3% | |
| Which of the following devices do you use on a daily basis | Smartphone | 378 | 34.9% | 704 | 65.1% | .567 |
| | Tablet | 29 | 31.2% | 64 | 68.8% | |
| | Computer | 41 | 29.7% | 97 | 70.3% | |
| | TV | 12 | 37.5% | 20 | 62.5% | |
| What is the total number of hours of usage of all digital devices you use on a daily basis | < 1 hour | 30 | 61.2% | 19 | 38.8% | .001* |
| | 1-5 hours | 180 | 32.0% | 383 | 68.0% | |
| | 6-10 hours | 185 | 35.2% | 341 | 64.8% | |
| | > 10 hours | 65 | 31.4% | 142 | 68.6% | |

| | | | | | | |
|--|--------------------|-----|-------|-----|-------|-------|
| What is the average viewing distance from the eye to the computer? | < 40 cm | 222 | 31.8% | 476 | 68.2% | .048* |
| | 40-75 cm | 222 | 37.6% | 368 | 62.4% | |
| | > 75 cm | 16 | 28.1% | 41 | 71.9% | |
| What is the Level of computer screen as compare to eye? | Equal to eye level | 369 | 35.2% | 678 | 64.8% | .319 |
| | Above eye level | 68 | 30.5% | 155 | 69.5% | |
| | Below eye level | 23 | 30.7% | 52 | 69.3% | |

4. DISCUSSION

Computer vision syndrome which is also titled digital eye strain includes a group of eyes- and vision-related signs and symptoms due to excessive computer, e-reader, tablet and cell phone use (Blehm et al., 2005; Wimalasundera, 2009). Many persons complain of eye discomfort and vision glitches when watching digital screens for long duration. The degree of discomfort mostly positively related to the duration of digital screen use (Gowrisankaran & Sheedy, 2015; Randolph, 2017). Prolonged watching a computer or digital screen usually puts the eyes under stress. So, the exclusive features and high visual needs of computer and digital screen viewing increase individuals' susceptibility to the development of vision-related symptoms (Mehra & Galor, 2020). Neglected vision problems can augment the severity of computer vision syndrome (CVS) or digital eyestrain symptoms (Dessie et al., 2018). Public awareness regarding computer vision syndrome and its consequences can prevent the related visual problems which may end with visual impairment with affected their quality of life. The current study aimed to assess public awareness regarding computer vision syndrome among eastern population, Saudi Arabia. Also, the study aimed to assess the digital devices utilization habits among the study participants with associated symptoms of CVS. Regarding utilization habits of electronic devices, the current study showed that the most reported used electronic devices were smartphones (80.4%) while other electronic devices utilization rate was not common among participants including computers (10.3%), and tablets (6.9%). About 42% used the devices for 1-5 hours daily and more than one third (39.1%) used the devices for 6-10 hours, while only 3.6% used devices for less than 1 hour which indicated high utilization rate. As for participants practices during electronic devices utilization, about 44% of the participants reported that the average viewing distance from the eye to the computer is 40-75 cm and but vast majority of them (77.8%) use the level of computer screen as same level to eye. These findings coincide with literature evidence for increased utilization rate of electronic devices and social media during the last few years (Cain & Gradisar, 2010; Rideout et al., 2010; Kawabe et al., 2016; Ahmed et al., 2021).

As for public awareness of computer vision syndrome, the current study showed that about one third of the study population (34.2%) know about CVS and more than half of hem (52.8%) applying the 20 / 20 / 20 rule. Awareness was significantly higher among participants with low use of electronic devices and among those who practice safe use by keeping appropriate distance from the electronic device viewed screen. Similar findings were reported by Patil et al., (2019) who found that 22.5% individuals, while 53.9% and 23.5% had average and poor knowledge, respectively. Poor sleep quality was present in 75.49% of individuals. Also, Kushali et al., (2020) reported that nearly 30% of the population were aware of CVS. About 42% of the study population views the display at about 4-5 inches below the eye level. Most of the population were aware of preventive measures regarding CVS. In Nigeria, Akinbinu et al., (2013) viewed as that 40% of the participants knew about CVS; of which 27% knew about the issue. CVS was common among the employees, 74% of the respondents.

As for experienced symptoms, the current study showed that vast majority of the participants (92.3%) experienced eye strain, for headache, difficulty focusing, and Sensitivity to bright light, with eye dryness. These are the most reported CVS associated symptoms among all literature reviews (Altalhi et al., 2020; Rosenfield, 2011; Bali, 2014). In Saudi Arabia, high commonness of CVS was noticed, in which 95% had somewhere around one manifestation during concentrating on utilizing computers. Most revealed symptoms were excessive tearing and neck, shoulder, or back torment (Altalhi et al., 2020).

5. CONCLUSION

In conclusion, the current study showed that there is a high utilization rate with unsafe practices during electronic devices utilization among study participants. CVS associated symptoms are comment and highly frequent among all participants especially eye related symptoms which were more than muskelo-skeletal symptoms. Public awareness regarding CVS was not satisfactory where about 1 out of each 3 know about the syndrome. There is a pressing need to further develop public awareness in regard to health impacts identified with prolonged computer and electronic devices use and to show the protected practice and measures to decrease CVS symptoms.

Acknowledgements

We thank the participants who were all contributed samples to the study.

Author contribution

All authors of this study were equally involved in the design of the study, data collection, analysis, drafting and correction of the final draft, and the author was responsible for the proper implementation of the study at all stages. There is no author whose name is not listed in the authors list.

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical approval

The study was approved by the King Fahad Hospital-Hofuf (ethical approval code: 45-EP-2021).

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there are no conflicts of interest.

Data and materials availability

All data associated with this study are present in the paper.

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